



Design-in Guide

Philips Surge Protection Device 277V

October 2011

PHILIPS
sense and simplicity

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1. Introduction to this guide

Thank you for choosing the Philips Surge Protection Device 277V (SPD). This product will help protect your Outdoor lighting installation against damaging spikes in mains voltage, including high surges caused by lightning. The design-in guide provides instructions on how to install the SPD in your luminaire, including optimal wiring design and information on both Class I and Class II installations.

Information or support

If you require any further information or support please consult your local Philips office or visit:

- Support www.philips.com/support
- Surge Protection Device www.philips.com/surgeprotection
- Xitanium drivers www.philips.com/xitanium
- OEM general info www.philips.com/oem

2. Surge Protection Device 277V



Philips Surge Protection Device 277V

2.1 Applications

The Philips Surge Protection Device 277V (SPD) is designed for integration into Class I and Class II luminaires for outdoor use.

The International Electro technical Commission (IEC) standard 61643-11/2007 recognizes three types of surge protection devices.

Type 1

Type 1 is recommended in specifically for service-sector and industrial buildings. The device is protected by a lightning protection system or a mesh cage. It protects electrical installations against direct lightning strikes. Type 1 is characterized by a 10/350 μ s current wave.

Type 2

Type 2 is a common protection system for all low-voltage electrical installations. Installed in an electrical switchboard, this device prevents the spread of over-voltage in electrical installations and protects the loads. Type 2 is characterized by an 8/20 μ s current wave.

Type 3

Type 3 is characterized by a combination of voltage waves (1.2/50 μ s) and current waves (8/20 μ s) and is typically used for local protection of sensitive loads.

The Philips Surge Protection Device 277V is a type 3 product.

2.2 Compatibility with other products

The Philips Surge Protection Device can be used in combination with various electronic drivers and different lamp types (e.g. LEDs, HID and fluorescent lamps).

2.3 The challenge for Outdoor lighting

High surge currents can destroy outdoor lighting systems!

Outdoor lighting systems are used in various types of applications, such as street and road lighting, parking areas and tunnels. In many of these installations there is a risk of extreme surges (e.g. lightning strikes). A direct hit will most likely destroy the components in a luminaire. Even an indirect hit near the lighting installation might cause severe damage. An indirect hit usually results in large surge currents, sometimes as high as 5 kA. The figures 1a and 1b show a simplified model what happens to a luminaire without surge protection during a lightning strike. Charge is built-up between the cloud and earth (figure 1a), until the potential difference is large enough to initiate a lightning strike. Following the strike, the charge is returned from the luminaire via L-N to the cloud (figure 1b).

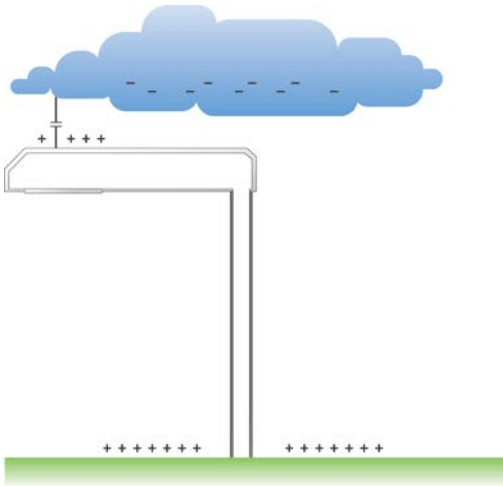


Figure 1a. Charge built-up

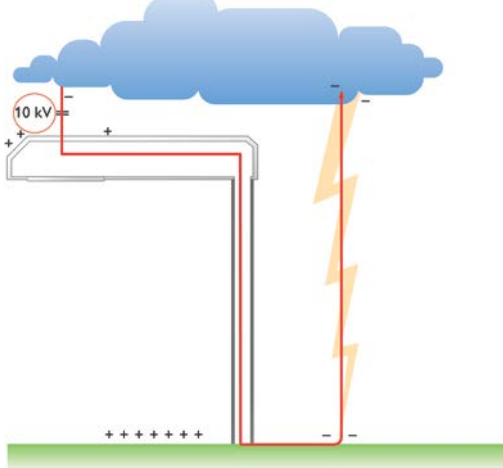


Figure 1b. Large currents caused by indirect lightning hit

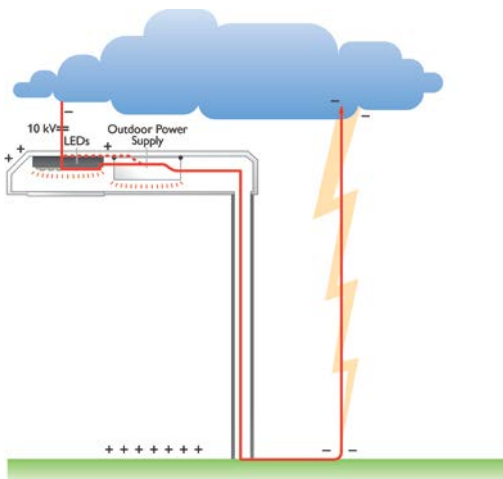


Figure 2. Surge currents damage the luminaire

A voltage between the L-N terminals of the power supply (differential mode) as well as between the terminals and the luminaire (common mode) is being built up and an electrical breakdown between L-N and/or the luminaire will take place. The resulting surge voltage and surge current of this electrical breakdown can reach critical levels which can destroy the power supply and/or LED module. The path of the surge current can go through the LED module and partly through the power supply (shown in the red line) or through the power supply only (dotted red line) in figure 2.

2.4 The solution: Surge protection

A reliable way to protect your outdoor luminaires from excessive surge voltages is to use the Surge Protection Device 277V (SPD). This device limits the differential and common mode surge voltage inside the luminaire by offering a path with a lower break down voltage. The energy of the voltage surge is returned as a surge current, via the Device to the ground and eventually back to the cloud. The Philips Surge Protection Device is capable of handling multiple strikes with a nominal current up to 5kA. It is even designed to handle a single strike between 5 to 10kA, in the unlikely event of larger surge currents.

In a Class I system the SPD has to be connected to the protective earth of the installation. In a Class II luminaire, the SPD will use only the functional earth / housing of the luminaire to protect the light source. Please refer to chapter 4.4 for more information.

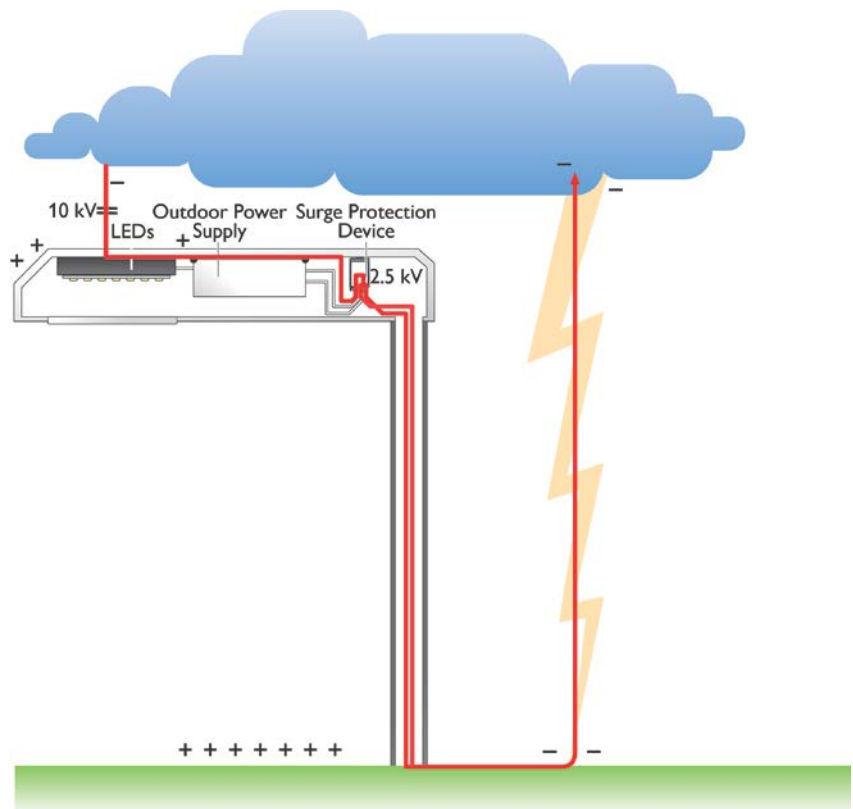


Figure 3. Surge currents bypass the light engine via the Surge Protection Device, protecting the luminaire

3. Mechanical design

This chapter covers the mechanical design characteristics of the Surge Protection Device 277V.

3.1 Casing

The Philips Surge Protection Device is suitable for use in all outdoor luminaires. Voltage Dependent Resistors (VDRs) are used for surge protection. The function of a VDR is to clamp a surge voltage to a safe level. The design assures good thermal stability of the SPD over lifetime and a low casing temperature even if the device is used beyond end of life. The SPD has been tested for thermal stability and is compliant with the IEC61643-11:2002 +A11:2007 standard.

3.2 Installation note

On the label you will find an arrow indicating the mounting position of the product (Figure 4). It is important to mount the device with the connection terminals facing downward to prevent moisture accumulation on the terminals.

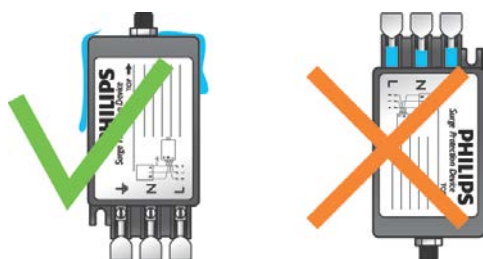


Figure 4. Mounting direction

3.3 Product dimensions

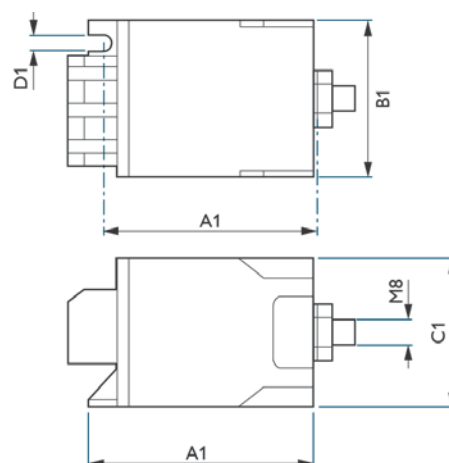


Figure 5. Product dimensions

A1 length	89 mm
A2 fixing hole distance length	70 mm
B1 width	41 mm
C1 height	38 mm
D1 fixing hole diameter	4.3 mm
Mounting screw type	M8

3.4 Cabling for screw terminals

The screw terminals are capable of handling wires / double wire ends with a cross section of 0.5 - 4 mm².

3.5 CAD drawings

3D CAD drawings are available on www.philips.com/surgeprotection.

3.6 Double wire ends

In order to ensure a proper connection of the wires to the Surge Protection Device we advise the use of double wire-ends, as shown in Figure 6.

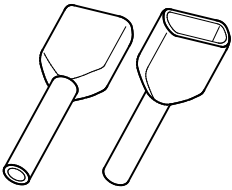


Figure 6. Double wire ends

4. Electrical design



Warnings

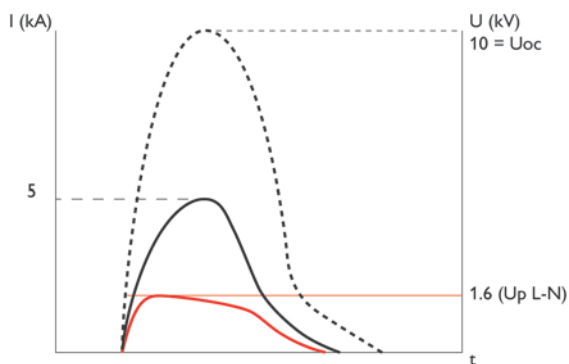
- Before installation or maintenance, switch-off the power.
- Avoid touching live parts!

This chapter covers the electrical design characteristics which are critical for designing a Class I or Class II luminaire.

4.1 Correct wiring

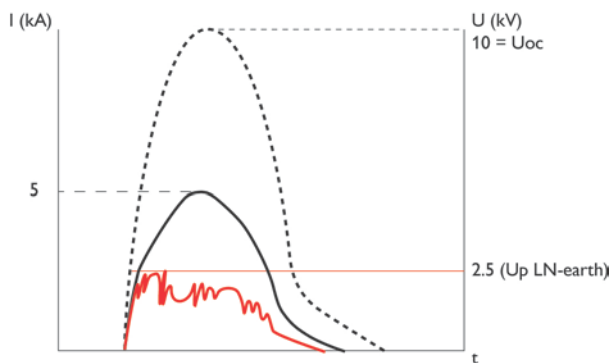
The specified protection level of 1.6 kV between L and N (differential mode) is possible when keeping the wires short and making sure the wires go directly to the power supply. It is therefore not recommended to mount the Surge Protection Device in the pole. During a strike the residual surge voltage close to the terminals of the power supply -at the end of the long wires could be higher than the specified protection level (U_p) at the Surge Protection Device. In cases where mounting in the pole is the only option, it is necessary to perform additional measurements in the luminaire to define the maximum achievable protection level. Between L-N and the luminaire enclosure (common mode) a protection level of 2.5 kV is possible. Figures 7 and 8 show the typical voltage and current waves resulting from differential mode and common mode strikes.

When connecting the Surge Protection Device you are advised to follow EMC guidelines; keep wires short, keep mains power away from low voltage signal circuits, etc.) This will minimize the distance and wire length between the SPD and the mains voltage entry point. It is also recommended to minimize the earth wire length to safety earth (Class I application) or functional earth point (Class II application) of the luminaire, Figure 9a and 9b. Please note that mains wires go into the Surge Protection Device and leave the Surge Protection Device at the same point (star point connection). Double wire ends can be used to maintain a proper connection.



----- surge test voltage
——— surge current
——— protection level

Figure 7. Differential mode



----- surge test voltage
——— surge current
——— protection level

Figure 8. Common mode

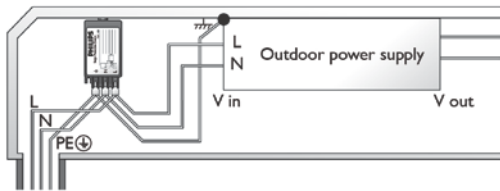


Figure 9a. Correct wiring in a Class I luminaire

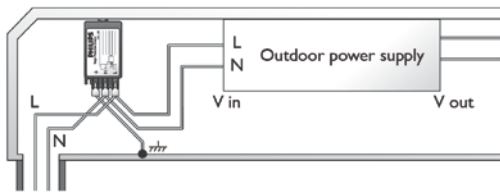


Figure 9b. Correct wiring in a Class II luminaire

4.2 Class I and Class II luminaires

The difference between a Class I and Class II system is the grounding method.

In a Class I system, safety is realized by an earth connection from the driver to the luminaire enclosure.

A Class II system does not have a protective earth as the safety measure is built in the driver / light module, making sure that live parts would not come into contact with conductive parts of the luminaire in case of a single fault condition.

4.3 Wiring in a Class I luminaire

A Class I protective earth connection can be wired as indicated in *Figure 9a*. This solution offers product safety as well as protection against high surges.

4.4 Wiring in a Class II luminaire

For Class II the device can still be used to offer protection between luminaire casing and mains power. All metal surfaces in the luminaire should be connected to an earth star point and then these surfaces can be used as a functional earth providing good surge protection. The earth connection of the surge protector should be wired to this star point, *Figure 9b*.

4.5 Incorrect wiring

If the SPD is not wired correctly, it will not be able to protect up to the levels specified.

Examples of incorrect wiring include:

1. Installing unprotected wires (wire which do not go via the Surge Protection Device) in parallel (Figure 10) with the protected wires (output wires of the device)
2. Crossing of unprotected and protected wires (Figure 10)
3. Not connecting the input and output wires as a star point to the Surge Protection Device (Figure 11)
4. Unnecessary long wiring (Figure 12)

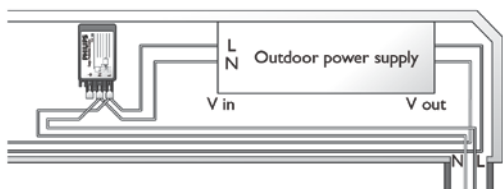


Figure 10. Incorrect wiring examples 1 and 2

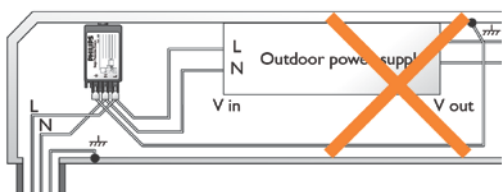


Figure 11a. Incorrect wiring example 3

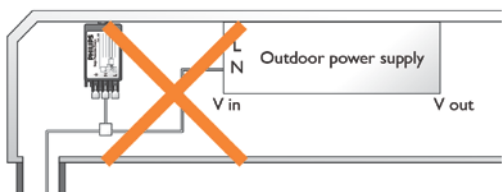


Figure 11b. Incorrect wiring example 3

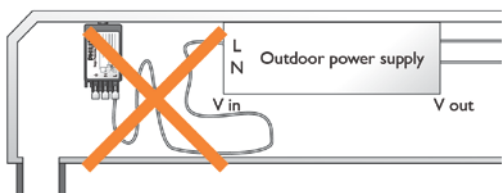


Figure 12. Incorrect wiring example 4

4.6 Compliance testing during luminaire release and manufacturing

For Class II luminaires, the double or reinforced insulation shall be respected. The guidelines below describe how to test a Class II luminaire with the Philips Surge Protection Device 277V.

Type testing of luminaire (at certified body)

Overvoltage protective devices which are connected to earth or a reference point shall be used only in fixed luminaires. A fixed luminaire is a luminaire that cannot be easily moved from one place to another, either because the fixing is such that it can only be removed with the aid of a tool, or because it is intended for use out of arm's reach.

Overvoltage protective devices which comply with IEC 61643 can be disconnected from the circuit for the dielectric strength test of IEC 60598-1 sub clause 10.2.2, but only for fixed luminaires.

Factory testing (100%)

The ENEC 303 advises routine testing for luminaire manufactures, to test dielectric strength as described in clause 1.3 (also known as high-pot test). Due to the nature of the Surge Protection Device, a dielectric strength test would automatically result in a failure, as the clamping of the device is below the testing voltage. In such a case, the note described in clause 1.3 allows that the insulation test may be carried out applying 500V dc for 1 sec, with the insulation resistance of not less than 2MΩ.

4.7 Fusing and mains power distribution system

Fusing

Standard outdoor applications require fuses to protect the installation. This can be done via the main circuit breakers (MCB) and/or fuses. For optimum protection of your luminaire we recommend installing a MCB 16A fuse with B type switch-off characteristic when using the SPD. Because the SPD has a power consumption below 0.1 W and does not impact the inrush current, so luminaire fusing is similar whether or not the SPD is used.

Please note that the Surge Protection Device is designed exclusively for use **inside** a luminaire and should not be mounted on the exterior of the housing.

Suitability in power distribution systems

System	Suitability Surge Protection Device
TN power distribution system	Class I and II luminaires
TT power distribution systems	Class II luminaires
IT power distribution system	Not suitable

TN power distribution system

In a three phase TN power distribution system the Neutral (N) is connected to the start point of the 3 phases and connected to earth via a low impedance. The Protective Earth (PE) wire is also connected to the same point and part of the wiring to the end user.

TT power distribution systems

In a TT mains power distribution system, the PE conductor is not part of the wiring to the customer. The PE conductor should be sourced by the end user locally. For example via a local earth pin.

IT power distribution system

In an IT mains power distribution system, the N and PE conductors are not wired to the end user. The end user should provide only a local earth conductor.



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10/2011

www.philips.com/surgeprotection
www.philips.com/oem